



Crisscrossing trusses of the 1950 bridge frame new caisson construction below.



Kari Hamilton

It's not just a man's world anymore. On the Narrows Bridge Project, women comprise nearly 10 percent of the workforce, performing as field engineers, ironworkers, welders, and carpenters.



Kari Hamilton

Bridge surveyor at work on the Gig Harbor caisson.



An aerial panorama of the Tacoma Narrows bridge construction; east anchorage appears in the foreground.



Crews dredge the seabed below the Gig Harbor caisson so that it will sink an additional 57 feet and reach its final position.



Swift currents create challenging work conditions. The tides travel on average 5.5 knots, continuously surging against the fortress-like walls of the caissons.



New Bridge Vital Statistics

Bridge Length:

5,400 ft. (overall)

Main Span:

2,800 ft. (tower to tower)

Deck Panels:

46 sections, 120 ft. by 78 ft. (each)

Tower Height:

510 ft. tall
8,500 cubic yds. concrete

Tower Foundations

or **Caissons:** (each)

- 1.7 million lbs. steel (total)
- 850,000 lbs. steel (base or cutting edge)
- 6 million lbs. rebar
- 30,000 cubic yards concrete

Anchorages (each):

- 20,600 cubic yards concrete
- 900,000 lbs. rebar

Cable Diameter: 21 inches

Steel Bundles per Cable: 19

Wires per Bundle: 464

Structural Steel:

30.5 million lbs.
(excludes weight of cables.)

40.3 mil. lbs.

(all steel excluding towers)

The New Tacoma Narrows Bridge

NEW PARALLEL BRIDGE COMPLETED BY: EARLY 2007

1950 BRIDGE (RETROFIT) COMPLETED BY: EARLY 2008

In the two years since the Washington State Department of Transportation began the Tacoma Narrows Bridge Project, the overall project is nearly half complete. The \$849 million project consists of constructing a parallel suspension bridge, improving 2.5 miles of roadway on State Route 16, and improving existing bridge. The new bridge will open to traffic in spring 2007 with the entire project finishing in early 2008.

Currently, the Tacoma Narrows Bridge (TNB) is the world's largest suspension bridge under construction. The TNB project represents only the second suspension bridge to be built in the United States in four decades.

Safety and reliability come first

Constructing what will be the third bridge to span the Tacoma Narrows will improve the safety of motorists and freight carriers who travel on State Route 16.

When the second bridge was built in 1950, it was intended to handle 60,000 vehicles a day, not the 90,000 that travel the roadway today. Engineers estimate 120,000 vehicles will use the bridges by 2020. The new bridge project will improve the ability of people and freight to move safely, reliably and conveniently during any hour of the day.

At a Glance

Project Scope:

3.4 miles of roadway (including bridge)

Boundaries:

Jackson Avenue NW (Tacoma) to just west of new 36th Street NW (Gig Harbor Peninsula)

Start Date:

Broke Ground October 2002

New Bridge Completed: Spring 2007

1950 Bridge Retrofit Completed: Early 2008

Owner:

Washington State Department of Transportation

Contractor: Tacoma Narrows Constructors

(Joint venture: Bechtel and Kiewit)

Cost of Project: \$849 million

Part Paid By Tolls: \$800 million

Initial Toll: \$3 roundtrip (per vehicle)
collected Eastbound direction only

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For more information about the bridge project, visit the
TNB web site: www.tacomanarrowsbridge.com



**Washington State
Department of Transportation**

BRIDGE TIMELINE

2002

September: WSDOT and Tacoma Narrows Constructors officially started design work of Narrows Bridge

October: Groundbreaking ceremony held Oct. 5

2003

January: Roadway construction begins

March: First cutting edge launched from Seattle for delivery to Port of Tacoma

April: Second cutting edge launched from Seattle for delivery to Port of Tacoma

July/August: Caissons (bridge foundations) towed into Narrows

September: New 24th St NW underpass opens

October: Westbound SR 16 ramps at 24th St NW open to traffic; East anchorage fully excavated and related concrete pours begin

December: Gig Harbor caisson reaches seabed: 1st Touch Down

2004

January: Tacoma caisson reaches seabed: 2nd Touch Down; West anchorage fully excavated

February: Deck and suspension cable fabrication begin in Korea; West anchorage concrete pours begin

March: Air domes cut out of both caissons, and dredging begins

May/June: Caissons reach full height and are sealed

July: Tower construction begins

2005

April: Tower construction and anchorages to be completed

August: Suspension system underway with cable spinning

2006

February: Deck construction begins

2007

New bridge complete in spring; opens to traffic in temporary lane configuration

2008

Existing bridge retrofit complete; eastbound traffic on new bridge and westbound traffic on old bridge



24th Street NW Overpass



Gig Harbor SR 16 Improvements

Parallel bridges mean new traffic configuration

A suspension bridge is the bridge style structural engineers use to cross the longest spans. The existing 1950 bridge, a mile in length, is the fifth longest bridge in the United States. The new parallel bridge will be just as long and a mere 60 feet south the current bridge.

In 2007, eastbound and some westbound traffic to Tacoma will travel across the new bridge while the existing bridge undergoes a seismic retrofit that will improve its performance during an earthquake.

Each bridge will be configured to provide two general-purpose and one high occupancy vehicle (HOV) lane. The 1950 bridge (westbound traffic) will have three 12-foot lanes with 2-foot inside and 8-foot outside shoulders. The new bridge (eastbound traffic) will have three 12-foot lanes and 10-foot inside and outside shoulders, and 10-foot separated bike path.

The two bridges will function in tandem with the State Route 16 corridor improvements* and, ultimately, ease traffic congestion across the Narrows.

**Starting in spring 2004 through 2007, major roadway improvements along SR 16 will begin between Tacoma's Nalley Valley Viaduct and 36th Street NW near Gig Harbor.*



Caisson Float-Out

Getting the project done on time and within budget

No matter what the project, the Washington State Department of Transportation makes every effort to complete construction projects on time and on budget. The Narrows Bridge Project features a new contract method in Washington state called "design build". Under this type of contract, project design and construction take place simultaneously under one contract. The project's contractor, Tacoma Narrows Constructors, is moving at an amazingly fast pace. Because construction is concurrent with design, the timeline for the TNB project is a *full two years shorter* than if the state had pursued a typical contract. Under a typical "design-bid-build" contract, bridge design would be near complete. Construction would not have begun.

Transportation officials have developed three measures to evaluate the efficiency of design-build contracting for the TNB project. They include:

- Schedule comparisons between traditional contract methods and the design-build method
- Project management and oversight of budgets (percentage of total capital costs)
- Contingency budget oversight (as a percent of total capital costs)



West Anchorage



East Anchorage

Right on schedule

Tacoma Narrows Constructors reached several milestones during the first 18 months of design-build construction. Structural engineers finished all aspects of bridge design; crews towed out and constructed the bridge foundations (caissons); the caissons were positioned on and embedded into the seabed; east and west anchorage sites were fully excavated and concrete pours begun. In addition, land crews completed major roadwork integral to the bridge project. Design engineers continue to finesse landscaping plans for the 2.3 miles of right-of-way adjacent to SR 16. More bridge hallmarks are on the way. But to date, the project is right on schedule.

Project cost summary

The capital cost for the Tacoma Narrows Bridge project is \$760.4 million. The chart below illustrates project budget and expenditures to date. Financing costs and reserve debt service (\$88 million) associated with construction, brings the total projected cost of the project to \$849 million.

Expenditures as of April 2004.

Project Cost Summary (in Millions)	Budgeted	Expended
Design-Build Contract	615.0	340.9
Toll System Contract	9.2	1.4
WSDOT Oversight	41.0	8.3
Contingencies	54.7	4.1
Phase I Dev. Cost (UIW)	40.5	39.9
Total	760.4	394.6
Total Expended/Total Cost	51.8%	



Caisson Construction below West Tower of Bridge

BRIDGING OUR PAST TO THE PRESENT



In 1940, when the first Narrows Bridge opened to traffic it earned the distinction of being the world's third largest suspension bridge. More than two-dozen engineers and 200 laborers made up the team of builders. It took 19 months to complete the job with workers putting in around-the-clock shifts.

Those of us who live in the Pacific Northwest – maybe anyone on planet earth – know the tale of the first bridge, "Gallopig Gertie." It stood for four months with its deck flexing and rolling before it tore apart in a 40-mile-per-hour windstorm, and collapsed into Puget Sound.

Even today, the roller-coaster gyrations of Gertie remain one of the most mesmerizing images in Washington state history. But the story of the Tacoma Narrows goes far beyond the infamy of a fallen bridge. It is the story of the Narrows as home to indigenous people: Native Americans who lived on its shores 9,000 years ago. It's a chronicle of bridge-building science, and how that first bridge contributed immensely to advances in structural engineering and the evolution of the suspension bridge. Bridges are machines with massive parts — foundations, anchorages, towers — that together with the principles of physics allow them to stay suspended.

The Narrows Bridge also is a story about art and architecture. The Art Deco styles of the 1920s and 1930s greatly influenced building design, including bridge architecture. The sleek, symmetrical and geometric lines of this structure make the suspension bridge appear delicate. But compared to other bridge types (beam and arch), it is the strongest. Importantly, bridges connect people and places and ideas. The Tacoma Narrows is a tale about people: commuters, students, and the recreation-minded who travel the span daily; the men who built the first and second bridges; and, the team of designers, engineers and craftspeople now tasked with building the third bridge.

For more on the history of the Tacoma Narrows and the science of bridge-building visit the web site: www.tacomannarrowsbridge.com and click on History.